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(54) **APPARATUS FOR THERMAL TREATMENTS OF METALS, PARTICULARLY FOR HARDENING AND TEMPERING STEEL**

VORRICHTUNG ZUR THERMISCHEN BEHANDLUNG VON METALLEN, INSBESONDERE ZUM HÄRTEN UND VERGÜTEN VON STAHL

APPAREIL POUR LE TRAITEMENT THERMIQUE DE MÉTAUX, PLUS PARTICULIÈREMENT POUR LA TREMPÉ ET LE DURCISSEMENT DE L'ACIER

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(73) Proprietor: **GF-ELTI S.R.L.
24060 Sovere (Bergamo) (IT)**

(72) Inventors:
• **Colombi, Claudio
24060 Riva di Solto BG (IT)**

• **Longaretti, Giovanni
24060 Costa di Mezzate BG (IT)**

(74) Representative: **Modiano, Micaela Nadia et al
Modiano & Partners
Via Meravigli, 16
20123 Milano (IT)**

(56) References cited:
**CN-U- 201 476 575 DE-A1- 3 315 751
DE-A1-102004 060 354 JP-A- S6 233 716
SU-A1- 443 923 US-A- 3 659 831
US-A- 3 684 263**

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Description

[0001] The present invention relates to an apparatus for thermal treatments of metals, particularly for hardening and tempering steel.

[0002] As is known, thermal treatments of metals are based on heatings and coolings at preset temperatures and for preset times so as to improve specific characteristics of the metals subjected to the treatment by way of a modification of their internal structure.

[0003] Thus, for example, the thermal treatment for hardening steel is based on a step of heating the steel to temperatures that for some types of steel can be even higher than 1000°C, followed by a step of fast cooling by immersion, usually in water or in other cooling liquids. The hardening and tempering treatment consists instead of a hardening treatment followed by a tempering step constituted by heating to a temperature usually comprised between 550°C and 650°C, followed by slow cooling in air or in a furnace.

[0004] Currently, in order to perform these treatments, in the case of pieces of steel of considerable size, the pieces are generally arranged, by means of bridge crane equipment, on supporting platforms covered suitably with refractory material, which are inserted in the reheating furnace. After heating, the material subjected to thermal treatment is removed, again by means of bridge crane equipment, from the platform used previously and loaded onto a second platform intended to be immersed in a tank that contains a cooling liquid by means of which the material subjected to thermal treatment is cooled.

[0005] If, as in the case of the hardening and tempering treatment, a second heating is required, the material subjected to treatment, once removed from the tank, must be transferred again onto the platform or carriage to be inserted in the furnace.

[0006] The passage from one platform to the other, in apparatuses of the traditional type, is forced by the need to have a platform that, in order to withstand the high temperatures of the furnace, must be covered suitably with refractory materials which, due to their nature, cannot be immersed in cooling liquids, such as for example water, since these liquids would cause their rapid breakup. For this reason, in order to immerse in the tank the material subjected to thermal treatment, it is necessary to use another platform, usually made of steel, which however would not be able to withstand the high heating temperatures inside the furnace.

[0007] The times required in order to perform the transfer from one platform to the other affect significantly the times and therefore the overall costs of the thermal treatment. Moreover, to perform this transfer it is necessary to use workers who work in an unhealthy environment and are exposed to the danger of accidents. The times required by the transfer often do not allow to comply fully with the times scheduled for performing a correct thermal treatment.

[0008] In order to solve these problems, an apparatus

has been devised which is the subject of German Patent DE-102004060354 B4, in which the reheating furnace is provided in two halves that face each other at a vertical central plane and can move toward and away from each other. This apparatus uses a movable carriage provided with supporting elements that define a substantially horizontal resting surface for the material subjected to thermal treatment.

[0009] The reheating furnace is arranged above a tank that contains a cooling liquid and the carriage, when it is in the furnace, rests on a platform that can be lowered into the tank.

[0010] The two halves of the heating furnace can move toward each other in order to move the two halves of the hearth of the reheating furnace to close below the supporting elements and can move away from each other in order to allow the carriage, arranged on the platform, to descend into the cooling liquid contained in the underlying tank.

[0011] The apparatus disclosed in patent DE-102004060354 B4, due to the fact that during the heating of the material subjected to treatment the hearth of the furnace is closed immediately below said material, allows to avoid the use of refractory material in the provision of the carriage and thus allows to use a same carriage to support the material subjected to treatment both during heating in the furnace and during cooling in the tank.

[0012] Due to this fact, the apparatus disclosed in patent DE-102004060354 B4 allows to speed up the operations for moving the material subjected to thermal treatment and therefore to reduce the overall times required by the treatment. In particular, such apparatus allows to reduce the time that elapses between the heating and the tank cooling of the material, allowing to perform particular thermal treatments that cannot be performed with apparatuses of the traditional type.

[0013] In contrast with these advantages, the apparatus disclosed in patent DE-102004060354 B4, since it requires the provision of the reheating furnace in two halves that must mate, suffers the drawback of greater complexity in the design and provision of the reheating furnace.

[0014] The aim of the present invention is to provide an apparatus for thermal treatments of metals, particularly for hardening and tempering steel, that can retain the advantages of the apparatus disclosed in patent DE-102004060354 B4 without complicating excessively the design and manufacture of the reheating furnace. Other integral quench tank and tempering furnace systems comprising vertical and horizontal transfer means for batch hardening are disclosed in each one of US-A 3 684 263, US-A 3 659 831, JP-62 033 716 and CN2014 765 75U.

[0015] Within this aim, an object of the invention is to provide an apparatus that allows to speed up the operations for moving the material subjected to thermal treatment so as to reduce the minimum times required in order to pass from heating to cooling of the material subjected

to thermal treatment, thus allowing to fully comply with the heating and cooling times even of the most critical thermal treatment cycles.

[0016] Another object of the invention is to provide an apparatus that allows to move the material subjected to thermal treatment in a highly automated manner.

[0017] A further object of the invention is to provide an apparatus that also allows to reduce the overall costs of the thermal treatments.

[0018] This aim and these and other objects that will become better apparent hereinafter are achieved by an apparatus for thermal treatments of metals, particularly for hardening and tempering steel, as defined in claim 1.

[0019] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the apparatus according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figures 1 to 4 are schematic sectional front views, taken along a vertical plane, of the apparatus according to the invention during the execution of the various steps of a thermal treatment.

[0020] With reference to the figures, the apparatus according to the invention, generally designated by the reference numeral 1, comprises a reheating furnace 2 and means 3 for moving the material 4 subjected to thermal treatment.

[0021] According to the invention, the means 3 for moving the material 4 subjected to thermal treatment comprise a carriage 5 provided with first supporting elements 6 which define a substantially horizontal resting surface 7 for the material 4 subjected to thermal treatment. The carriage 5 can be actuated to move the material 4 subjected to thermal treatment into and out of the heating furnace 2, as will become better apparent hereinafter.

[0022] The means 3 for moving the material subjected to thermal treatment also comprise second supporting elements 8, which can be inserted in the reheating furnace 2 below the resting surface 7 and are adapted to support the material 4 subjected to thermal treatment as a replacement of the first supporting elements 6.

[0023] The second supporting elements 8 are movable in order to perform the transition of the material 4 subjected to thermal treatment from the reheating furnace 2 to a tank 9 that contains a cooling liquid and vice versa.

[0024] Conveniently, the first supporting elements 6 are mutually spaced along a first substantially horizontal direction 10 (at right angles to the surface of the sheet in the figures) and the second supporting elements 8 are also mutually spaced along the first direction 10 and can move along a second direction 11, which is substantially horizontal and perpendicular to the first direction 10, so that they can be inserted in the spaces or extracted from the spaces that exist between the first supporting elements 6.

[0025] In greater detail, the carriage 5 comprises a substantially horizontal bed 12 that is provided in a downward

region with wheels 13 that can engage a pair of rails 14. The first supporting elements 6 are arranged above the bed 12 and can be constituted by piers made of steel or refractory material that are arranged mutually side by side and spaced conveniently along the first direction 10.

[0026] The second supporting elements 8 are constituted by longitudinal members 15 arranged horizontally, which are arranged mutually side by side and are spaced conveniently along the first direction 10, so as to correspond to the spacing between the first supporting elements 6, so that each one can be inserted in the space between two adjacent piers 6.

[0027] The movement means 3 comprise means for lifting-lowering the second supporting elements 8 along a vertical direction 16 in order to disengage the material subjected to thermal treatment 4 from the first supporting elements 6.

[0028] The lifting-lowering means comprise beams 17, which are arranged vertically outside the reheating furnace 2 proximate to its side walls and can engage the longitudinal ends of the longitudinal members 15 that protrude laterally from the reheating furnace 2, on mutually opposite sides, even when the longitudinal elements 15 are inserted in the reheating furnace 2 between the first supporting elements 6. The beams 17 are engaged with a supporting structure 21 that extends around and above the reheating furnace 2 and are provided with a set of sheaves or pinions engaged by cables or chains. The cables or chains can be actuated to lift and lower the longitudinal members 15 during the various steps of the thermal treatment, as will be described in detail hereinafter.

[0029] The longitudinal members 15 are made of a material, for example commercially available special steel, that withstands the temperatures at which the heating of the material subjected to treatment in the reheating furnace 2 is performed, usually around 1,100°C. It should be noted that the longitudinal members 15, as better explained hereinafter, are inserted in the reheating furnace 2 after performing the heating of the material 4 subjected to thermal treatment and therefore remain exposed to these temperatures for a limited time.

[0030] The beams 17, as well as the other elements used for the lifting and lowering of the longitudinal members 15, since they are arranged outside the reheating furnace 2, do not require the use of particular materials or solutions in order to withstand the high temperatures.

[0031] Conveniently, the reheating furnace 2 is open in a downward region and can move from a working position, in which it rests with its base on the bed 12 of the carriage 5, to at least one open position, raised with respect to the working position, so as to allow the movement of the carriage 5 and/or the insertion, in the heating furnace 2, between the bed 12 and the resting surface 7, of the longitudinal members 15 of the second supporting elements 8 between the first supporting elements 6 or the extraction from the reheating furnace 2 of the longitudinal members 15 of the second supporting elements

8.

[0032] The reheating furnace 2 is provided, in a per se known manner, with a door 18, for example a sliding door suspended from a corresponding supporting structure 19, that can be opened to allow the insertion and extraction of the material 4 subjected to thermal treatment loaded onto the carriage 5.

[0033] The reheating furnace 2 is supported by the supporting structure 21 and the lifting and lowering of the reheating furnace 2 in order to pass from the working position to the at least one open position can be achieved by means of winches or other suitable lifting elements of a known type.

[0034] The extent of the lifting of the reheating furnace 2 must be sufficient to allow the insertion, within the reheating furnace 2, of the second supporting elements 8 between the first supporting elements 6 below the material 4 subjected to thermal treatment.

[0035] Advantageously, the reheating furnace 2 is arranged above the tank 9 so as to reduce as much as possible the time that elapses between the end of the heating performed in the reheating furnace 2 and the beginning of the cooling performed by means of the immersion of the material 4 subjected to thermal treatment in the cooling liquid contained in the tank 9.

[0036] The tank 9 can be made of steel or concrete and is arranged inside a below-grade compartment.

[0037] Conveniently, in the tank 9 there are means for recirculating the cooling liquid so as to increase the effectiveness of the cooling. These recirculation means can be constituted, for example, by impellers 20 that can be actuated on command.

[0038] The rails 14, which define the movement path for the carriage 5, are preferably arranged parallel to the first direction 10 at least proximate to the reheating furnace 2. The movement of the carriage 5 along the rails 14 can be actuated in a per se known manner, for example by means of a rack-and-pinion system or pulled by means of cables or chains or also by means of direct motorization of the wheels 13.

[0039] Advantageously, at least the portions of the rails 14 that are arranged above the tank 9 can move on command mutually closer or away from each other so as to support the carriage in the reheating furnace 2 and not hinder the descent of the second supporting elements 8 into the tank 9.

[0040] The heating of the reheating furnace 2 can be performed by way of means of a known type, for example burners, and the inner walls of the reheating furnace 2 are conveniently lined with a layer of thermal insulation.

[0041] Operation of the apparatus according to the invention is as follows.

[0042] The material 4 subjected to thermal treatment is deposited on the piers 6 of the carriage 5, while said carriage is translated laterally to the reheating furnace 2, by means of equipment of a known type, constituted for example by bridge crane equipment. Subsequently, with the door 18 of the reheating furnace 2 open and with the

reheating furnace 2 raised enough to allow the passage, below its front and lateral walls, of the carriage 5, the carriage 5 is moved along the rails 14 so as to center it in a downward region with respect to the reheating furnace 2. At this point, the door 18 of the reheating furnace 2 is closed and the reheating furnace 2 is lowered so as to create a suitable seal between its base and the upper face of the bed 12 of the carriage 5, as shown in Figure 1.

[0043] It should be noted that with the reheating furnace 2 in this position and with the door 18 closed, inside the reheating furnace 2 there are only the first supporting elements 6, i.e., the piers and the material 4 subjected to thermal treatment, while the remaining part of the carriage 5 is outside the reheating furnace 2 and therefore is not exposed to the temperatures that are reached inside the reheating furnace 2 during the heating of the material 4 subjected to thermal treatment.

[0044] The reheating furnace 2 is thus started, for example by means of the ignition of the burners, so as to bring the material 4 subjected to thermal treatment to the required temperature for a preset time.

[0045] Once the heating of the material has ended, the reheating furnace 2, together with its door 18, is raised just enough to allow the insertion of the longitudinal members 15 between the piers 6 below the material 4 subjected to thermal treatment that rests thereon, as shown in Figure 2. Once the insertion of the longitudinal members 15 has ended, the reheating furnace 2 is raised further and with it also the door 18 and the longitudinal members 15, as shown in Figure 3. The lifting of the longitudinal members 15 causes the lifting of the material that is disengaged from the piers 6. At this point the carriage 5 can be extracted from the reheating furnace 2, freeing the underlying region. Once the carriage 5 has been extracted from the reheating furnace 2, if necessary in order to allow the descent of the longitudinal members 15 and thus of the material 4 subjected to thermal treatment into the tank 9, it is possible to move mutually apart the portions of rails 14 that are arranged below the reheating furnace 2.

[0046] Subsequently, the longitudinal members 15 with the material 4 subjected to thermal treatment are lowered and immersed in the cooling liquid contained in the tank 9, as shown in Figure 4.

[0047] It should be noted that the immersion of the material 4 subjected to thermal treatment in the cooling liquid contained in the tank 9 can be performed very quickly, since it is aided by the force of gravity.

[0048] Once the cooling of the material has been performed, the longitudinal members 15 are raised again so as to extract the material 4 subjected to thermal treatment from the cooling liquid contained in the tank 9. If the thermal treatment to be performed is constituted by hardening alone, the material is rested again on the carriage 5, which is repositioned below the reheating furnace 2 after the longitudinal members 15 have been moved to a suitable height, in order to be moved to a loading and unloading region, where said material is unloaded by means

of equipment of a known type, constituted for example by bridge crane equipment.

[0049] If the thermal treatment is constituted by hardening and tempering, before moving away the material 4 subjected to thermal treatment, the reheating furnace 2 is lowered again, the door 18 is closed and a new cycle of heating the material is started at the end of which the material 4 subjected to thermal treatment is moved away by means of the movement of the carriage 5.

[0050] In practice it has been found that the apparatus according to the present invention achieves fully the intended aim and objects, since it allows to simplify and speed up the operations for moving the material subjected to thermal treatment, particularly as regards the passage of the material from the reheating furnace to the tank containing the cooling liquid, though allowing a relatively simple execution of the reheating furnace.

[0051] Another advantage of the apparatus according to the invention is that it can be highly automated, limiting the use of labor and reducing the risks of injury and/or accidents.

[0052] In the apparatus according to the invention, the reduced times required to pass the material subjected to thermal treatment from the reheating furnace to the tank containing the cooling liquid allow to comply fully with the times required by the most critical thermal treatments that require an extremely fast transition from the heating step to the cooling step.

[0053] The apparatus thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0054] In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

[0055] The disclosures in Italian Patent Application No. MI2014A001365 from which this application claims priority are incorporated herein by reference.

[0056] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An apparatus for thermal treatments of metals, particularly for hardening and tempering steel, comprising a reheating furnace (2) and means (3) for moving the material (4) subjected to thermal treatment, **characterized in that** said means (3) for moving the material (4) subjected to thermal treatment comprise:

- a carriage (5) provided with first supporting elements (6) that define a substantially horizontal resting surface (7) for the material (4) subjected to thermal treatment; said carriage (5) being movable for insertion in said reheating furnace (2) and for extraction from said reheating furnace (2) of the material (4) subjected to thermal treatment; and

- second supporting elements (8), which can be inserted in said reheating furnace (2) below said resting surface (7) and are adapted to support the material (4) subjected to thermal treatment as a replacement of said first supporting elements (6);

said second supporting elements (8) being movable in order to perform the transition of the material (4) subjected to thermal treatment from said reheating furnace (2) to a tank (9) that contains a cooling liquid and vice versa, said tank (9) being arranged below said furnace (2), said first supporting elements (6) being mutually spaced along a first substantially horizontal direction (10), said second supporting elements (8) being also mutually spaced along said first direction (10) and being movable along a second direction (11), which is substantially horizontal and perpendicular to said first direction (10), in order to enter the space between said first supporting elements (6), said movement means (3) comprising means for lifting-lowering said second supporting elements (8) along a vertical direction (16) in order to disengage the treated material from said first supporting elements (6).

2. The apparatus according to claim 1, **characterized in that** said carriage (5) comprises a substantially horizontal bed (12) on which said first supporting elements (6) are arranged.

3. The apparatus according to claim 2, **characterized in that** said reheating furnace (2) is open in a lower region and can move from a working position, in which it rests with its base on said substantially horizontal bed (12) of the carriage (5), to at least one open position, which is raised with respect to said working position, in order to allow the movement of said carriage (5) and/or insertion in said reheating furnace (2), between said bed (12) and said supporting surface (7) of said second supporting elements (8) between said first supporting elements (6), or the extraction from the reheating furnace (2) of said second supporting elements (8).

4. The apparatus according to one or more of the preceding claims, **characterized in that** said reheating furnace (2) is arranged above said tank (9), said second supporting elements (8) being movable, by way of the action of said lifting-lowering means, along

said vertical direction (16) in order to immerse in the cooling liquid or extract from the cooling liquid the material (4) subjected to thermal treatment.

5. The apparatus according to one or more of the preceding claims, **characterized in that** said lifting-lowering means of the second supporting elements (8) are arranged outside said reheating furnace (2) and can engage the ends of said second supporting elements (8) that protrude laterally from said reheating furnace (2), with said second supporting elements (8) inserted between said first supporting elements (6).
6. The apparatus according to one or more of the preceding claims, **characterized in that** said carriage (5) is provided with wheels (13) that engage rails (14).
7. The apparatus according to claim 6, **characterized in that** said rails (14), at least proximate to said reheating furnace (2), are oriented parallel to said first direction (10).
8. The apparatus according to one or more of the preceding claims, **characterized in that** at least the portions of said rails (14) that are arranged above said tank (9) can move on command toward or away from each other in order to support said carriage (5) in said reheating furnace (2) or to allow the descent of said second supporting elements (8) in said tank (9).
9. The apparatus according to one or more of the preceding claims, **characterized in that** in said tank (9) there are means for recirculation of the cooling liquid inside the tank (9).

Patentansprüche

1. Eine Vorrichtung zur thermischen Behandlung von Metallen, insbesondere zum Härten und Vergüten von Stahl, die einen Nachwärmofen (2) und Mittel (3) zum Bewegen des Materials (4), das thermischer Behandlung unterzogen wird, umfasst; **dadurch gekennzeichnet, dass** die Mittel (3) zum Bewegen des Materials (4), das thermischer Behandlung unterzogen wird, Folgendes umfassen:

- einen Schlitten (5), ausgestattet mit ersten tragenden Elementen (6), die eine im Wesentlichen horizontale Auflagefläche (7) für das Material (4) bestimmen, das thermischer Behandlung unterzogen wird; wobei der Schlitten (5) zum Einführen in den Nachwärmofen (2) und zum Herausziehen des Materials (4), das thermischer Behandlung unterzogen wird, aus dem Nachwärmofen (2) beweglich ist; und

- zweite tragende Elemente (8), die unterhalb der Auflagefläche (7) in den Nachwärmofen (2) eingeführt werden können und ausgebildet sind, um das Material (4), das thermischer Behandlung unterzogen wird, im Austausch für die ersten tragenden Elemente (6) zu tragen;

wobei die zweiten tragenden Elemente (8) beweglich sind, um den Transport des Materials (4), das thermischer Behandlung unterzogen wird, aus dem Nachwärmofen (2) in einen Tank (9) durchzuführen, der eine Kühlflüssigkeit enthält, und umgekehrt; wobei der Tank (9) unterhalb des Ofens (2) angeordnet ist; wobei die ersten tragenden Elemente (6) entlang einer ersten im Wesentlichen horizontalen Richtung (10) voneinander beabstandet sind, wobei die zweiten tragenden Elemente (8) ebenfalls entlang der ersten Richtung (10) voneinander beabstandet und entlang einer zweiten Richtung (11) beweglich sind, die im Wesentlichen horizontal und zu der ersten Richtung (10) senkrecht ist, um in den Raum zwischen den ersten tragenden Elementen (6) einzutreten; wobei die Bewegungsmittel (3) Mittel zum Heben und Senken der zweiten tragenden Elemente (8) entlang einer vertikalen Richtung (16), um das behandelte Material von den ersten tragenden Elementen (6) zu lösen, umfassen.

2. Die Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der Schlitten (5) eine im Wesentlichen horizontale Unterlage (12), auf der die ersten tragenden Elemente (6) angeordnet sind, umfasst.

3. Die Vorrichtung gemäß Anspruch 2, **dadurch gekennzeichnet, dass** der Nachwärmofen (2) in einem unteren Bereich offen ist und sich aus einer Arbeitsposition, in welcher er mit seinem Sockel auf der im Wesentlichen horizontalen Unterlage (12) des Schlittens (5) aufliegt, in mindestens eine offene Position bewegen kann, die im Verhältnis zu der Arbeitsposition erhöht ist, um die Bewegung des Schlittens (5) und/oder das Einführen der zweiten tragenden Elemente (8) zwischen den ersten tragenden Elementen (6) zwischen der Unterlage (12) und der Auflagefläche (7) oder das Herausziehen der zweiten tragenden Elemente (8) aus dem Nachwärmofen (2) zu ermöglichen.

4. Die Vorrichtung gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** der Nachwärmofen (2) oberhalb des Tanks (9) angeordnet ist, wobei die zweiten tragenden Elemente (8) durch Wirkung der Hebe- und Senkelemente entlang der vertikalen Richtung (16) beweglich sind, um das Material (4), das thermischer Behandlung unterzogen wird, in die Kühlflüssigkeit einzutauchen oder aus der Kühlflüssigkeit herauszuziehen.

hen.

5. Die Vorrichtung gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Hebe- und Senkmittel der zweiten tragenden Elemente (8) außerhalb des Nachwärmofens (2) angeordnet sind und die Enden der zweiten tragenden Elemente (8) halten können, die seitlich aus dem Nachwärmofen (2) herausragen, wobei die zweiten tragenden Elemente (8) zwischen den ersten tragenden Elementen (6) eingeführt sind. 5 10
6. Die Vorrichtung gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** der Schlitten (5) mit Rädern (13) ausgestattet ist, die in Schienen (14) eingreifen. 15
7. Die Vorrichtung gemäß Anspruch 6, **dadurch gekennzeichnet, dass** die Schienen (14) zumindest in der Nähe des Nachwärmofens (2) parallel zu der ersten Richtung (10) ausgerichtet sind. 20
8. Die Vorrichtung gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** mindestens die Abschnitte der Schienen (14), die oberhalb des Tanks (9) angeordnet sind, sich auf Befehl zueinander oder voneinander fort bewegen können, um den Schlitten (5) in dem Nachwärmofen (2) zu tragen oder um das Absenken der zweiten tragenden Elemente (8) in dem Tank (9) zu ermöglichen. 25 30
9. Die Vorrichtung gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** sich in dem Tank (9) Mittel zur Rückführung der Kühlflüssigkeit in dem Tank (9) befinden. 35

Revendications

1. Appareil pour des traitements thermiques de métaux, en particulier pour durcir et tremper de l'acier, comportant un four de réchauffage (2) et des moyens (3) pour déplacer le matériau (4) soumis à traitement thermique, **caractérisé en ce que** lesdits moyens (3) pour déplacer le matériau (4) soumis à traitement thermique comportent : 40 45
 - un chariot (5) pourvu de premiers éléments de support (6) qui définissent une surface d'appui sensiblement horizontale (7) pour le matériau (4) soumis à traitement thermique, ledit chariot (5) étant mobile pour une insertion dans ledit four de réchauffage (2) et pour une extraction dudit four de réchauffage (2) du matériau (4) soumis à traitement thermique, et 50
 - des seconds éléments de support (8), qui peuvent être insérés dans ledit four de réchauffage 55

(2) sous ladite surface d'appui (7) et sont adaptés pour supporter le matériau (4) soumis à traitement thermique comme un remplacement desdits premiers éléments de support (6),

lesdits seconds éléments de support (8) étant mobiles afin de réaliser la transition du matériau (4) soumis à traitement thermique depuis ledit four de réchauffage (2) jusqu'à un réservoir (9) qui contient un liquide de refroidissement et vice versa, ledit réservoir (9) étant agencé sous ledit four (2), lesdits premiers éléments de support (6) étant mutuellement espacés le long d'une première direction sensiblement horizontale (10), lesdits seconds éléments de support (8) étant également mutuellement espacés le long de ladite première direction (10) et étant mobiles le long d'une seconde direction (11), qui est sensiblement horizontale et perpendiculaire à ladite première direction (10), afin d'entrer dans l'espace entre lesdits premiers éléments de support (6), lesdits moyens de déplacement (3) comportant des moyens pour lever-abaisser lesdits seconds éléments de support (8) le long d'une direction verticale (16) afin de désengager le matériau traité desdits premiers éléments de support (6).

2. Appareil selon la revendication 1, **caractérisé en ce que** ledit chariot (5) comporte un lit sensiblement horizontal (12) sur lequel lesdits premiers éléments de support (6) sont agencés.
3. Appareil selon la revendication 2, **caractérisé en ce que** ledit four de réchauffage (2) est ouvert dans une zone inférieure et peut se déplacer à partir d'une position de travail, dans laquelle il est en appui avec sa base sur ledit lit sensiblement horizontal (12) du chariot (5), jusqu'à au moins une position ouverte, qui est surélevée par rapport à ladite position de travail, afin de permettre le déplacement dudit chariot (5) et/ou l'insertion dans ledit four de réchauffage (2), entre ledit lit (12) et ladite surface d'appui (7) desdits seconds éléments de support (8) entre lesdits premiers éléments de support (6), ou l'extraction du four de réchauffage (2) desdits seconds éléments de support (8).
4. Appareil selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit four de réchauffage (2) est agencé au-dessus dudit réservoir (9), lesdits seconds éléments de support (8) étant mobiles, par l'action desdits moyens de levage-abaissement, le long de ladite direction verticale (16) afin d'immerger dans le liquide de refroidissement ou d'extraire du liquide de refroidissement le matériau (4) soumis à traitement thermique.
5. Appareil selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdits moyens

de levage-abaissement des seconds éléments de support (8) sont agencés à l'extérieur dudit four de réchauffage (2) et peuvent engager les extrémités desdits seconds éléments de support (8) qui font saillie latéralement à partir dudit four de réchauffage (2), avec lesdits seconds éléments de support (8) insérés entre lesdits premiers éléments de support (6).

6. Appareil selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit chariot (5) est pourvu de roues (13) qui peuvent s'engager dans des rails (14). 10
7. Appareil selon la revendication 6, **caractérisé en ce que** lesdits rails (14), au moins près dudit four de réchauffage (2), sont orientés parallèlement à ladite première direction (10). 15
8. Appareil selon une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**au moins les parties desdits rails (14) qui sont agencées au-dessus dudit réservoir (9) peuvent se rapprocher ou s'écarter l'une de l'autre sur instruction afin de supporter ledit chariot (5) dans ledit four de réchauffage (2) ou pour permettre la descentes desdits seconds éléments de support (8) dans ledit réservoir (9). 20
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9. Appareil selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** dans ledit réservoir (9), il existe des moyens pour la recirculation du liquide de refroidissement à l'intérieur du réservoir (9) . 30

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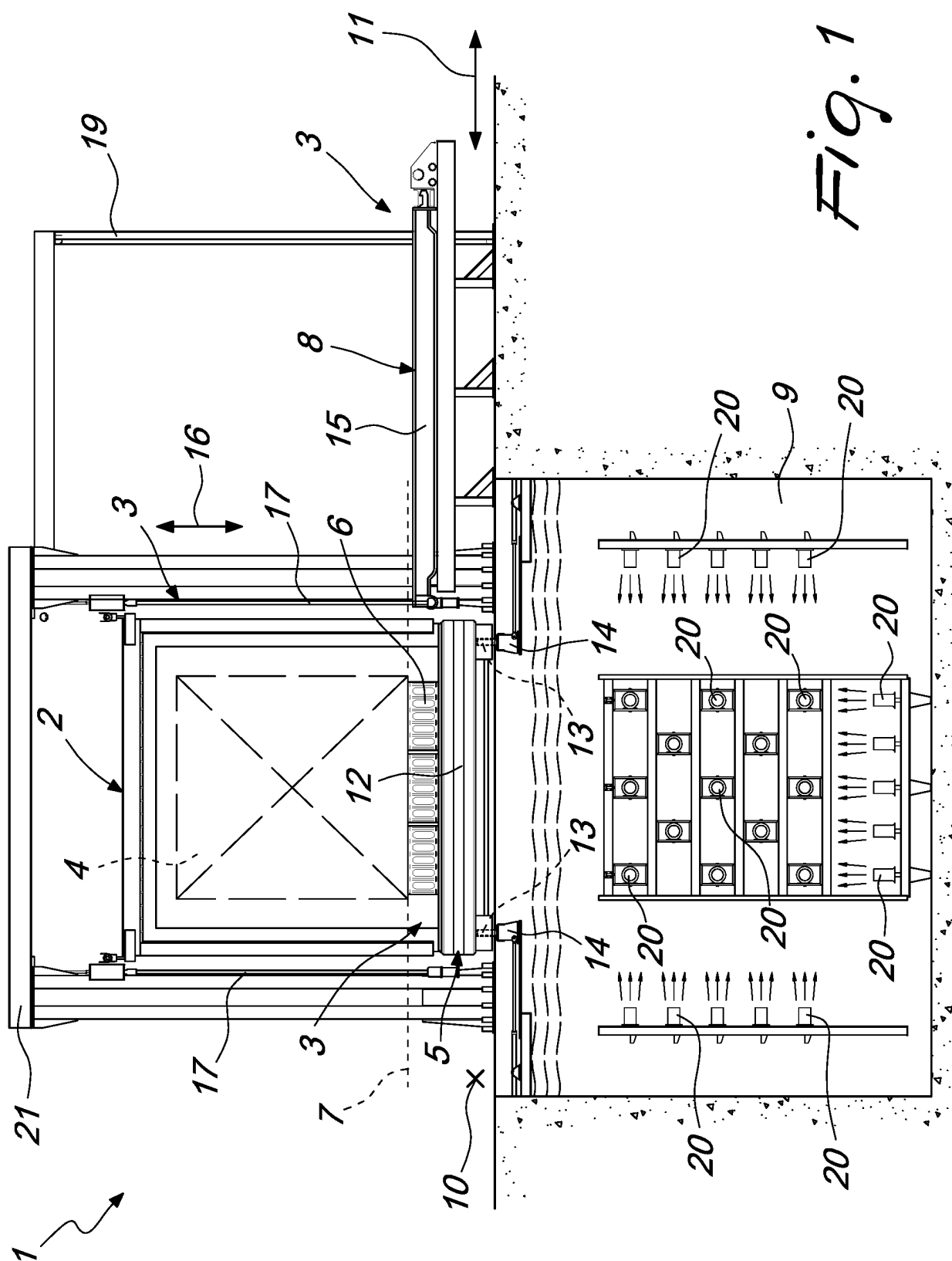
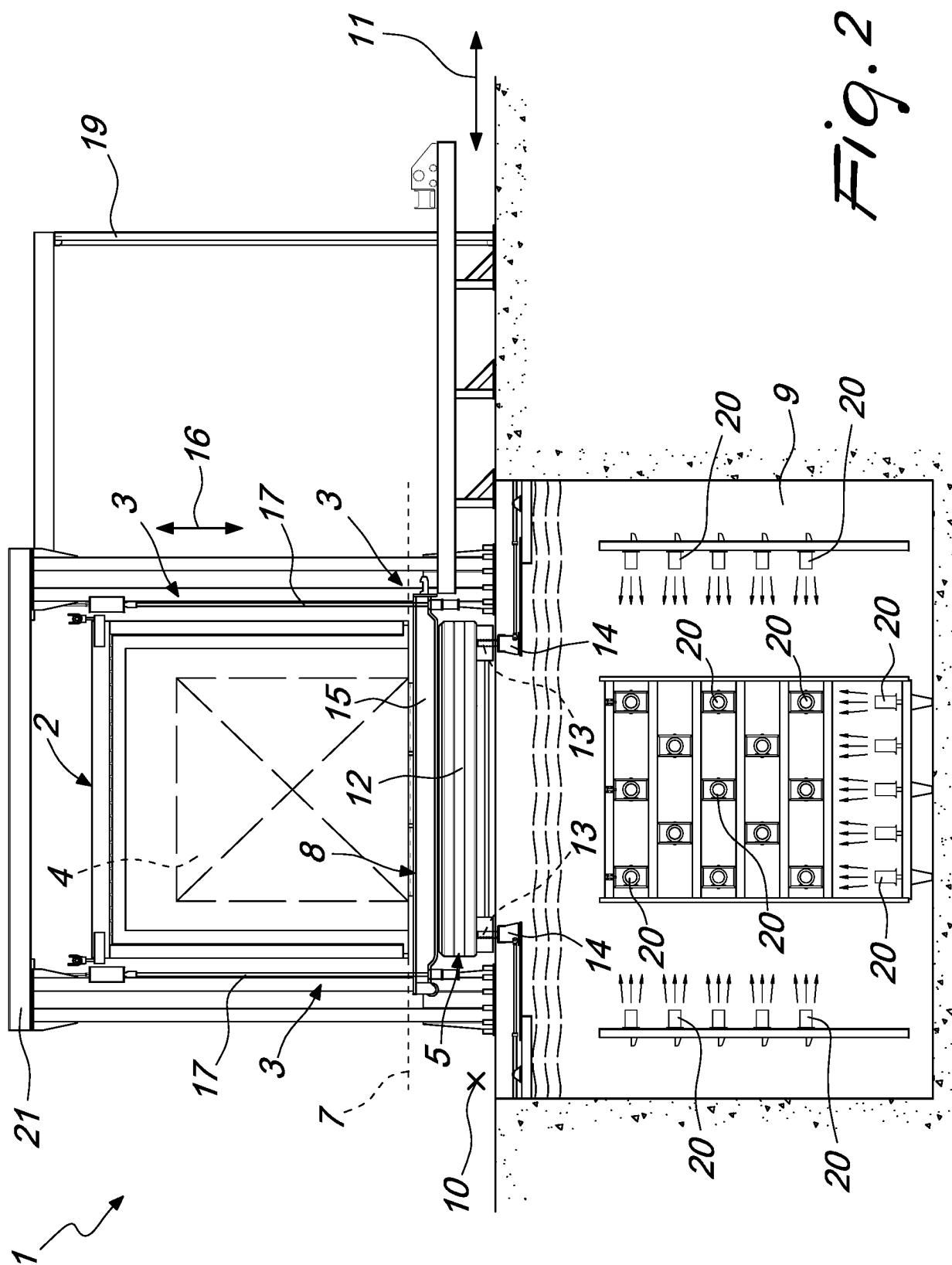
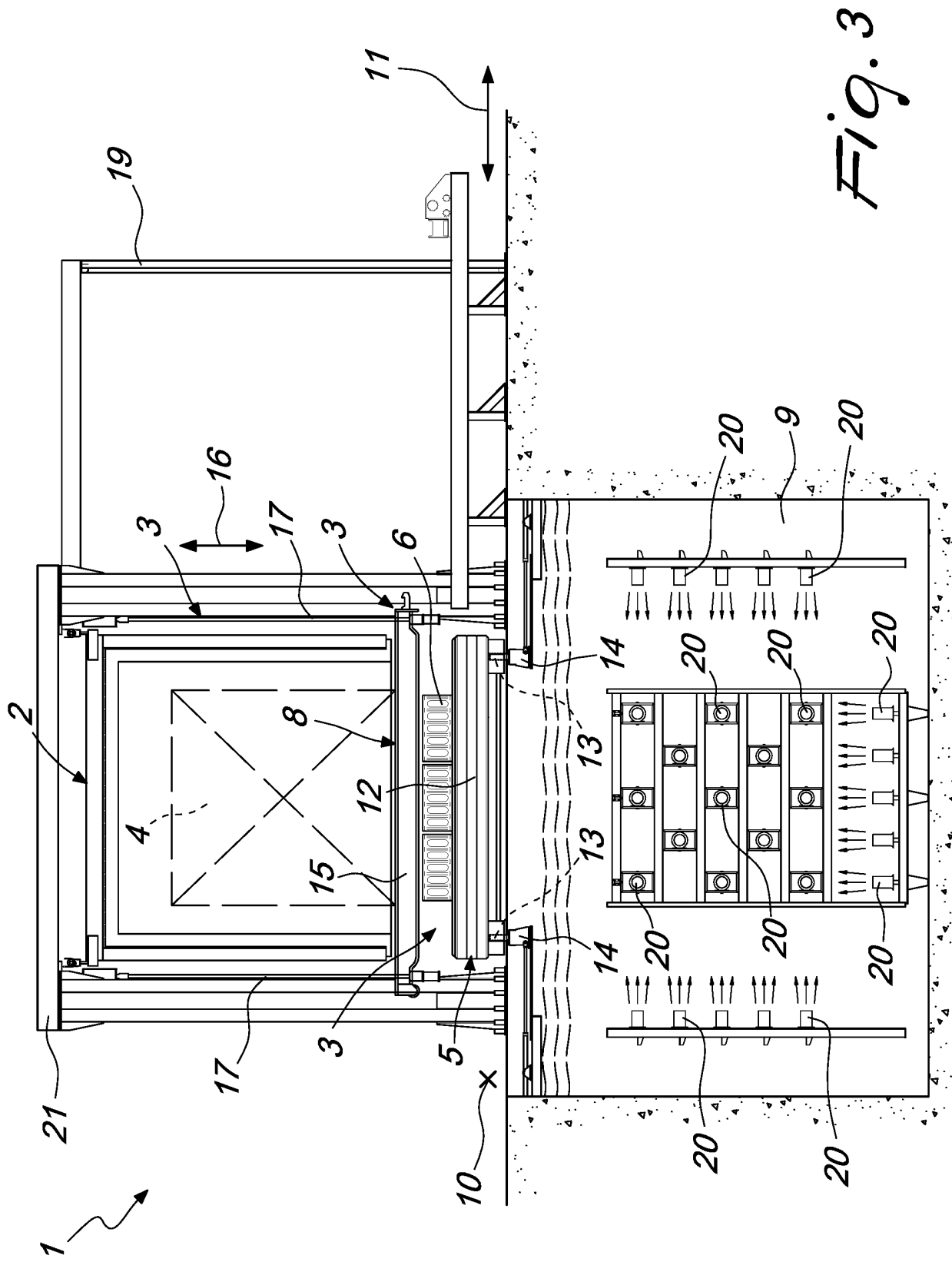
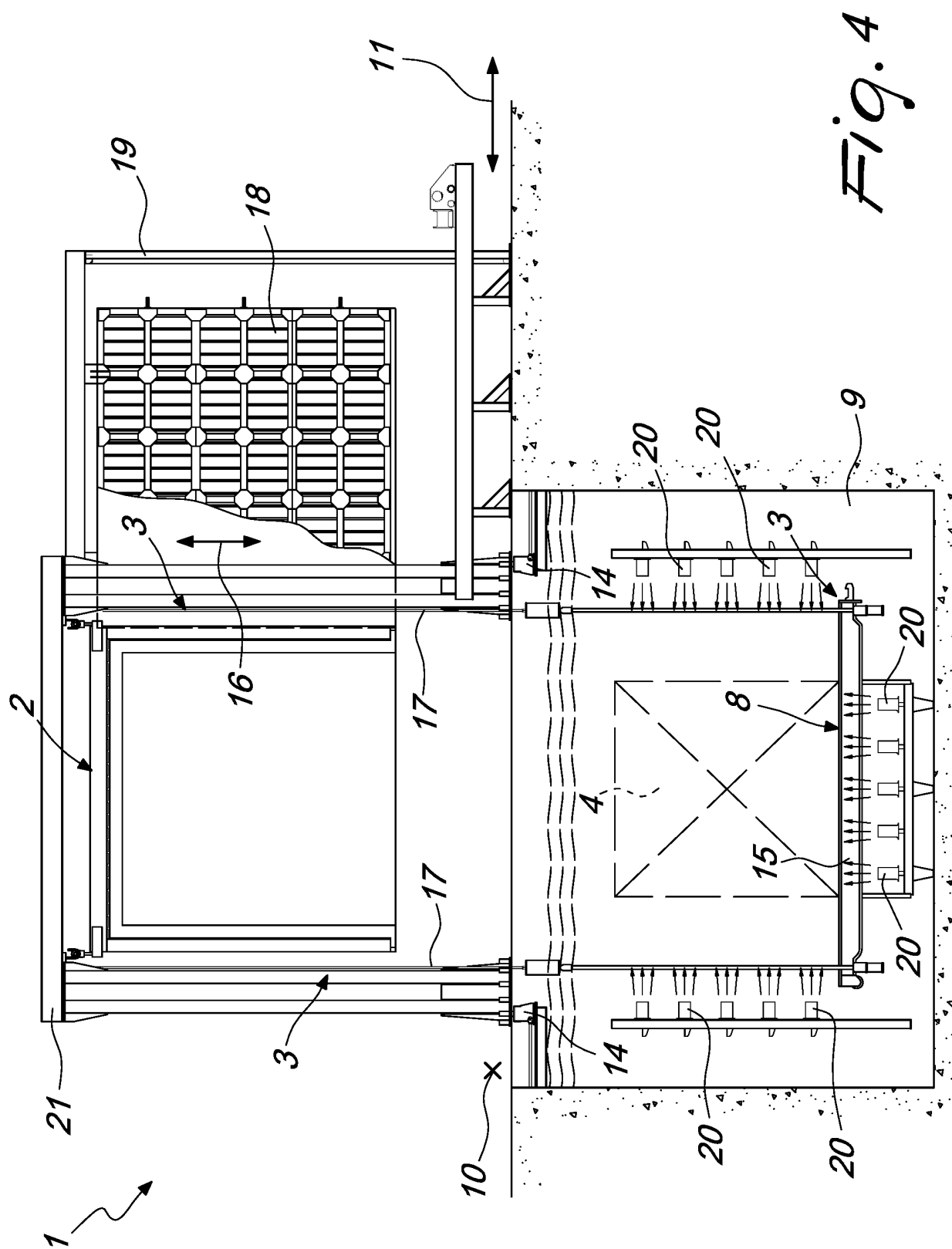


Fig. 1







REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 102004060354 B4 [0008] [0011] [0012] [0013] [0014]
- US 3684263 A [0014]
- US 3659831 A [0014]
- JP 62033716 B [0014]
- CN 201476575 U [0014]
- IT MI2014A001365 [0055]